The role of peripheral visual cues in planning and controlling movement

An investigation of which cues provided by different parts of the visual field influence the execution of movement and how they work to control upper and lower limb motion

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Abstract

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Keywords: peripheral visual cues, central visual cues, online control, feedforward control, visual exproprioception, visual exteroception, locomotion, obstacle crossing, postural stability, reaching and grasping.

Visual cues have previously been classified as visual exproprioceptive, when defining the relative position of the body within the environment and are continuously updated while moving (online), and visual exteroceptive when describing static features of the environment which are typically elaborated offline (feedforward). However peripheral visual cues involved in the control of movement have not previously been clearly defined

using this classification. Hence the role played by peripheral visual cues in the planning and/or online control of movement remains unclear.

The aim of this thesis was to provide a systematic understanding of the importance of peripheral visual cues in several types of movement, namely overground locomotion, adaptive gait, postural stability and reaching and grasping.

3D motion capture techniques were used to collect limb and whole body kinematics during such movements. Visual peripheral cues were manipulated by visual field occlusion conditions or by the employment of point-lights in a dark room.

Results showed that the visual cues provided by different parts of the peripheral visual field are mainly used for online fine tuning of limb trajectory towards a target (either a floor-based obstacle or an object to grasp). The absence of peripheral visual cues while moving disrupted the spatio-temporal dynamic relationship between subject and target and resulted in increased margins of safety between body and target and increased time and variability of several dependent measures. These findings argue in favour of the classification of peripheral visual cues as visual exproprioceptive.